

NAMES: ACTHUSI CHIKODILI YUDONGE.

MATRIC NO: 19/MHS/01/015

COLLEGE: MHS

DEPARTMENT: MBS

1) Give the following IUPAC names of the following compounds.

HCOOH - Methanoic acid

$\text{HOOCCCH}_2\text{CH}_2\text{COOH}$ - penten-1,5-dioic acid

$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ - Butanoic acid

$\text{H}_2\text{C}-\text{CO}_2\text{H}$ - Ethanoic acid or ethan-1,2-dioic acid

$\text{CH}_3(\text{CH}_2)_4\text{COOH}$ - Hexanoic acid

$\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{COOH}$ - Hex-4-enioic acid

2) Discuss briefly the physical properties of carboxylic acids under the following headings:

i) Physical appearance: All simple aliphatic carboxylic acids up to C₁₀ are liquids at room temperature. Most other carboxylic acids are solid at room temperature although anhydrous α -carboxylic acid (acetic acid), known as glacial ethanoic acid freezes into an ice-like solid below the room temperature.

ii) Boiling points: This increases with increasing relative molecular mass.

Aromatic carboxylic acids are crystalline solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

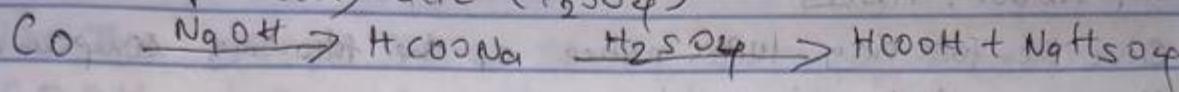
iii) Solubility: lower molecular mass carboxylic acids with up to four carbon atoms in their molecules are soluble in water, this largely due to their ability to form hydrogen bonds with water molecules. The water solubility of the acids decreases as the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and hence covalent. All carboxylic acids are soluble in organic solvent.

3) Write two industrial preparations of carboxylic acids

Ans: → from Carbon (II) oxide:

- Methanoic acid (formic acid) is manufactured by adding Carbon (II) oxide under pressure to hot aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with

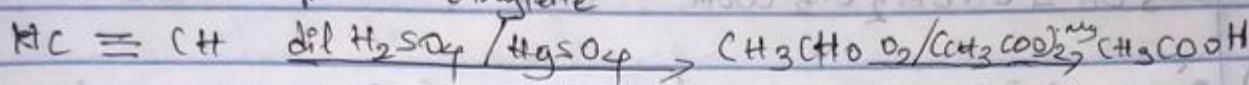
tetraoxosulphate(IV) acid (H_2SO_4)



basic conditions - $HCOONa$

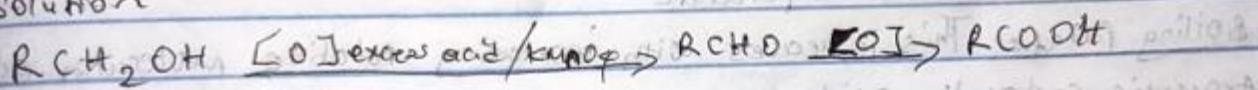
→ from ethanol $\xrightarrow{\text{acid}} 2\text{H}_2\text{O} + \text{CH}_3\text{COOH}$

ethanoic acid is obtained commercially by the liquid phase air-oxidation of 5% solution of ethanol to ethanoic acid using manganese (II) electrode as catalyst. Ethanol itself is obtained from ethylene - $\text{H}_2\text{C} = \text{CH}_2 \xrightarrow{\text{H}_2\text{O}} \text{H}_2\text{C}(\text{H})\text{CH}_3 \xrightarrow{\text{H}_2\text{O}} \text{H}_2\text{C}(\text{H})\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{CH}_3\text{COOH}$



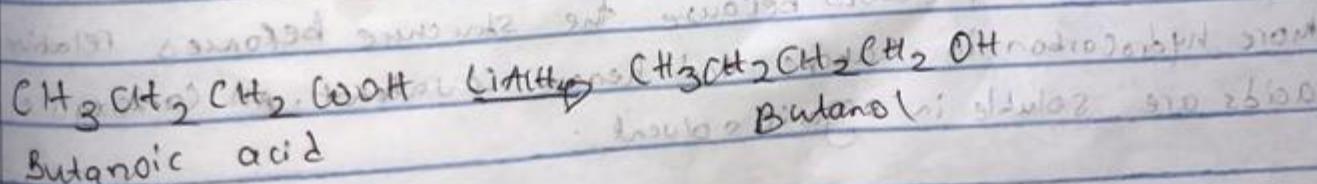
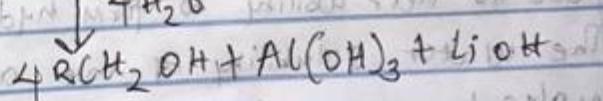
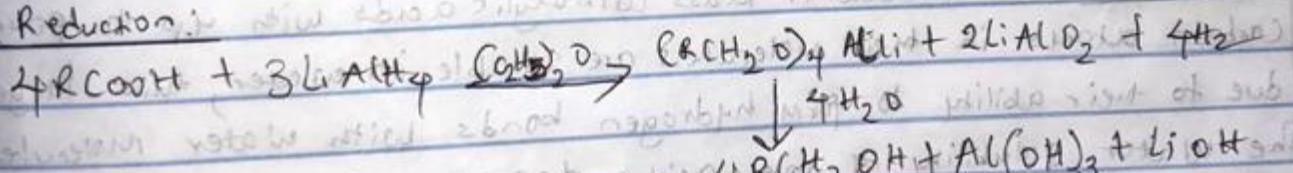
4) With reactions and brief explanation discuss the synthetic preparation of carboxylic acid.

→ oxidation of primary alcohol and aldehydes. The oxidation of primary alcohols and aldehydes can be used to prepare carboxylic acids using oxidizing agent (Cr_2O_7^2- or $\text{K}_2\text{Cr}_2\text{O}_7$) in acidic solution



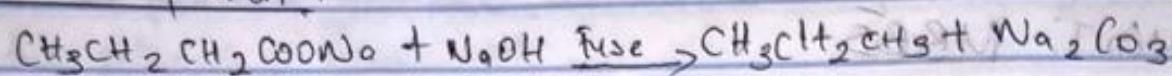
5) With chemical reaction only, outline the reduction, decarboxylation and esterification of carboxylic acid

Reduction:

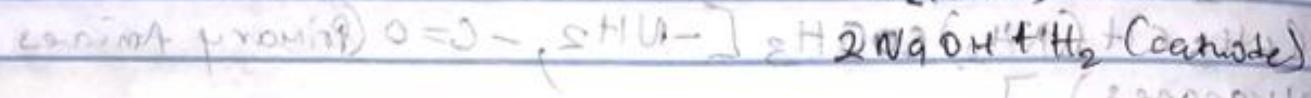
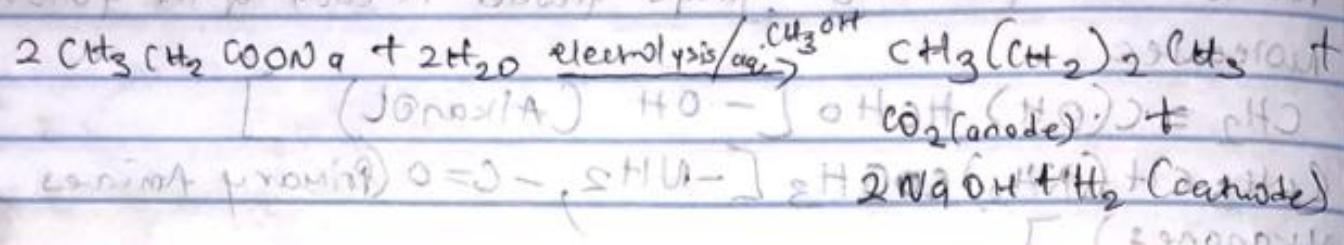


Butanoic acid

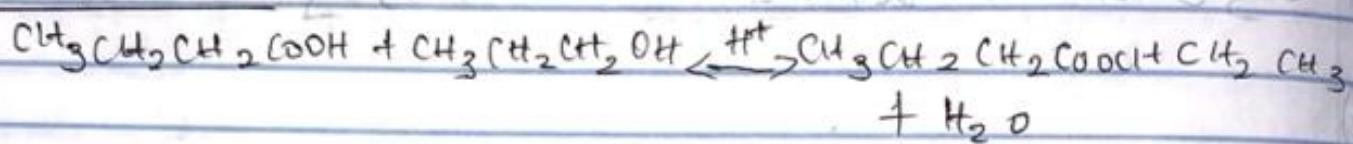
ii) Decarboxylation:



Kolbe Synthesis



iii) Esterification



→ HOOC (CH₂)₃ COOH